

DOUBLE CHIP SEAL, SLURRY SEAL, and CAPE SEAL

Section 500 - Mobilization

- 500.1** Mobilization shall include the costs for moving of equipment to and from the project site, the cost of bonds, permits and other licenses, costs of clean-up operations and other miscellaneous costs for which there is no specific bid item.
- 500.2** **Payment:**
The cost of mobilization is considered to be included in the various contract unit prices bid, and no additional compensation shall be made therefor.
- 500.3** **Notification:**
The Contractor shall notify all property owners adjacent to the work site a minimum of two (2) days in advance, of the date of beginning of work and a number to contact regarding the construction process.

Section 510 - Double Chip Seal

- 510.1** This work shall consist of an application of bituminous binder and a cover of screenings to be applied in accordance with the provisions of Section 37 "**Bituminous Seals**," of the Caltrans Standard Specifications and these Special Provisions.

Materials:

- A. Screenings:** Screenings shall conform to the grading specified for 3/8 inch x No. 6 medium for first application & 1/4 inch x 10 medium for second application.
- B. Bituminous Binder:** Bituminous binder shall be **Latex Modified CRS-2H Cationic Asphaltic Emulsion**. The Contractor shall be satisfied that the emulsion to be used on the project not only meets the minimum specifications stated, but is suitable for its intended use. If the emulsion provided leads to a substandard chip seal, even if it is **WITHIN** specification, the Contractor shall be responsible for any needed remedial work.

Rate of Application: Screenings and bituminous binder shall be applied at the following rates:

First Application for Double Chip Seal:

Bituminous Binder: 0.28 gallons per square yard

Screenings: 22 pounds per square yard

Second Application for Double Chip Seal:

Bituminous Binder: 0.25 Gallons per square yard, per each application.

Screenings: 20 pounds per square yard, per each application.

The Engineer reserves the right to approve the source and quantity of the Bituminous Binder and Screenings used.

510.2 Preparation of Surface:

The Contractor will prepare the surfaces to be chip sealed by brooming the surfaces with a power broom. The Contractor shall be responsible for performing supplemental cleaning and hand brooming as necessary. Compensation for such surface preparation shall be included in the unit prices paid for chip sealing.

The Contractor shall use air blowing or other approved methods and thoroughly clean all cracks larger than ¼" of all dirt, vegetation, and debris prior to the application of chip seal.

All cracks larger than ¼" shall be filled and sealed with a compatible hot-pour filler prior to applying the chip seal.

Compensation for such crack cleaning and surface preparation shall be included in the unit prices paid for chip seal application.

Contractor shall remove all concrete parking stop curbs prior to placement of the slurry seal and reinstall after completion of chip seal application.

Payment for temporary removals and reinstallations shall be included in contract prices paid for chip seal and no separate payment will be made therefor.

510.3 Excess Screenings:

All excess screening remaining on the pavement or in the gutters after completion of the chip sealing shall be removed by the Contractor, utilizing power brooms and hand brooming as necessary to the satisfaction of the City. As a minimum, the Contractor shall power broom each street twice, one day and three days after the application of the double chip seal. Appropriate warning signs shall remain in place until after the power brooming on day three. A final brooming shall be performed at least 30 days after the application of the double chip seal. Appropriate warning signs shall be removed after this final brooming. All left over screenings shall be disposed of offsite by the Contractor.

510.4 Finishing:

The Contractor shall finish the chip seal with an approved pneumatic roller.

510.5 Quality Control:

Materials:

The Contractor shall permit the City to take samples of the materials used in the project at the City's discretion. Test results will be compared to specifications.

The Contractor shall place trimmed construction weight paper or other City approved products over surface facilities such as manhole covers, valve boxes, utility vaults, and survey monuments to prevent the adhesion of chip seal to these facilities. After completion of the chip sealing operations, the Contractor shall remove any chip seal, which may have adhered to the above items. After the roads have been covered with chip seal they shall be made available for inspection by the City prior to the project acceptance. All excess materials shall be removed and disposed of by the Contractor.

510.6 Limitations:

Weather: The chip seal should not be applied if either the pavement or air temperature is below 60 degrees F and falling. No chip seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions delay opening to traffic beyond a reasonable time.

510.7 Measurement and Payment:

Payment for chip seal shall be at the Contract unit price per square yard for Double Chip Seal and shall include all labor, materials, equipment and other incidentals for said construction.

Section 520 - Slurry Seal

520.1 Slurry seal and all work shall be performed and conform to the provisions in Section 37-2, "***Slurry Seal***", of the Caltrans Standard Specifications and these Special Provisions. Aggregate shall be Type II spread at a rate of 14 pounds of dry aggregate per square yard. A latex additive, Ultra pave 70 (anionic), Ultra pave 65VC (cationic), or approved equal, shall be added at a rate 2 1/2% by weight to the asphalt emulsion.

The Contractor shall be responsible for locating areas for stockpiling materials and storing equipment required for this project.

The Contractor shall be satisfied that the emulsion to be used on the project not only meets the minimum specifications stated, but is suitable for its intended use. If the emulsion provided leads to a substandard slurry seal, even if it is **WITHIN** specification, the Contractor shall be responsible for any needed remedial work.

520.2 Equipment:

General: All equipment, tools and machines used in the performance of this work shall be maintained in satisfactory working order at all times.

Machine Calibration and Verification:

Calibration:

Each slurry-mixing unit to be used in performance of the work shall be calibrated in the presence of the City prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted provided such calibration was done dur-

ing the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering device(s). No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

Verification:

Each machine will make Test strips after calibration and prior to construction. Test strips shall be considered as a part of the project. Samples of the slurry seal will be taken and verification made as to mix consistency and proportioning. Verification of rate of application will also be made. Upon failure of any of the tests, additional test strips, at no cost to the City, will be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial will not be permitted to work on the project. Test strips must be accepted or rejected within 24 hours after application.

520.3 Composition, Rate of Application and Tolerances:

Composition:

The percentage of each individual material shall be as required by the laboratory report. Adjustments may be required during the construction, based on field conditions. The Engineer will give final approval for all such adjustments.

Rate of Application:

The slurry seal mixture shall be of proper consistency at all times so as to provide the amount of mixture required by the surface condition. The average application rate as measured by the City shall be 14 lbs./yd² (Type II Slurry).

Tolerances:

Tolerances for individual materials as well as the slurry seal mixture are as follows:

- A. After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.
- B. The percent of aggregate passing each sieve shall not vary more than $\pm 4.0\%$ from the job mix formula.
- C. The percent of aggregate passing shall not go from the high end to the low of the specified range of any two successive sieves.
- D. The slurry consistency shall not vary more than ± 0.5 cm from the job mix formula after field adjustments.

520.4 Limitations:

Weather:

The slurry seal should not be applied if either the pavement or air temperature is below 60 degrees F and falling. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions delay opening to traffic beyond a reasonable time.

Other:

No slurry seal shall be applied before 7 a.m. and it must be able to support traffic by 5 p.m.

520.5 Preparation of the Surface:

General:

Immediately prior to applying the slurry seal, the surface shall be cleared of all loose material, silt spots, vegetation, oil spots and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks will be allowed to dry thoroughly before slurry sealing. Manholes, valve boxes, drop inlets and other service entrances will be protected from the slurry seal by a method approved by the Engineer. The Engineer's onsite representative shall approve the surface preparation prior to sealing.

The contractor shall, by air blowing and/or other approved methods, thoroughly clean all cracks larger than ¼" of all dirt, vegetation, and debris prior to the application of slurry seal. All cracks larger than ¼" shall also be filled and sealed with a compatible hot-pour filler prior to applying the slurry seal.

All cracks larger than ¼" shall be filled and sealed with a compatible hot-pour filler prior to applying the slurry seal.

Compensation for such crack cleaning and surface preparation shall be included in the unit prices paid for slurry seal application.

Contractor shall remove all concrete parking stop curbs prior to placement of the slurry seal and reinstall after completion of slurry seal application.

Payment for temporary removals and reinstallations shall be included in contract prices paid for slurry seal and no separate payment will be made therefor.

520.6 Application:

General:

The surface would be pre-wetted ahead of the slurry box when required by local conditions. Water used in pre-wetting the surface shall be applied such that the entire surface is damp with no apparent flowing water in front of the slurry box. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity and dryness of the pavement surface.

The slurry mixture shall be of the desired consistency upon leaving the mixer and no additional materials shall be added. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided. No lumping, balling or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate, will be left in the finished surface. If excess oversize develops, the job will be stopped until the Contractor proves to the Engineer's onsite representative that the situation has been corrected.

Joints:

No excessive buildup, uncovered areas or unsightly appearance shall be permitted on longitudinal or transverse joints. An excessive overlap will not be permitted on longitudinal joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area.

Mix Stability:

The slurry mixture shall possess sufficient stability so that premature breaking of the slurry seal in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading, it shall be free of excess water or emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

Hand Work:

Areas, which cannot be reached with the slurry seal machine, shall be surfaced using hand squeegees to provide complete and uniform slurry seal coverage. The area to be hand-worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

Lines:

Care shall be taken to ensure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance.

Clean up:

All manhole covers, water valve boxes, and gutters, shall have slurry seal removed. The Contractor shall remove any debris associated with the performance of the work, on a daily basis.

After adequate drying time as recommended by the Manufacturer, the slurry seal shall be rolled with a rubber tired roller, a minimum of two full passes.

520.7 Quality Control:

Materials:

The Contractor shall permit the City to take samples of the aggregate and asphalt emulsion used in the project at the City's discretion. Gradation and sand equivalent tests may be run on the aggregate and residual asphalt content tests on the emulsion. Test results will be compared to specifications.

The Contractor shall place trimmed construction weight paper or other City approved products over surface facilities such as manhole covers, valve boxes, utility vaults, and survey monuments to prevent the adhesion of slurry seal to these facilities. After completion of the slurry sealing operations, the Contractor shall remove any slurry seal, which may have adhered to the above items. Prior to project acceptance, the facilities shall be made accessible for inspection by the City. All excess materials shall be removed and disposed of by the Contractor.

520.8 Measurement and Payment:

Payment for chip seal shall be at the Contract unit price per square yard for Double Chip Seal and shall include all labor, materials, equipment and other incidentals for said construction.

Section 530 - Cape Seal

530.1 General:

This item shall consist of a bituminous surface Street Absorbing Membrane (SAM) composed of a single application of asphalt-rubber material and pre-coated aggregate in accordance with these specifications.

530.2 Material Components:

A. Asphalt Cement

The type and grade of asphalt cement utilized to manufacture the asphalt-rubber binder shall be AR-4000, AR-8000 or Performance Graded (PG) asphalt cement, which shall comply with requirements of the Table No.530.1.

Table No. 530.1
*Asphalt Cement Grading Requirements

Climate	AASHTO M 226 ASTM D 3381	AASHTO M 20 ASTM D 946	SHRP GRADING REQUIREMENTS
Cold	AC2.5, AC-5 or AC-10 AR-2000	120-150 or 200-300	PG 52-28
Moderate	AC-5 or AC-10 AR-2000 or AR-4000	85-100 or 120-150	PG 58-22
Hot	AC-10 or AC-20 AR-4000 or AR-8000	60-70 or 85-100	PG 64-16 PG 70-10

The exact grade of asphalt cement shall be determined by the asphalt-rubber supplier, dependent of the specific project requirements and conditions (Climate and Traffic).

B. Asphalt Modifier

The asphalt modifier, if **required**, will be resinous, high flash point, aromatic hydrocarbon compound and shall conform to the requirements in Table No. 530.2.

Table No. 530.2
Asphalt Modifier Requirements

Test Parameter	ASTM Designation	Requirement
Viscosity, cSt. At 212° F (100°C)	D 445	X +/- 3
Flash Point, COC, degrees F ©	D 92	410° F (210° C) Minimum
Molecular Analysis: Asphaltenes, percent by weight	D 2007	0.1 Maximum
Aromatics, percent by weight	D 2007	55 Minimum

*The symbol "X" is the viscosity of the asphalt modifier the Contractor proposes to furnish. The Value of "X" which the Contractor proposes shall be between 19 and 36, and shall be submitted in writing to the City Engineer. Any proposed changes to these requirements requested by the Contractor, in the value "X" shall require a new asphalt-rubber binder design.

C. Granulated Reclaimed Tire Rubber and High Natural Rubber (CRM)

The CRM used shall be produced primarily from the processing of automobile and truck tires. The rubber shall be produced by ambient temperature grinding processes only. The high natural CRM (if required), shall consist of ground or granulated rubber derived from materials that utilize high natural rubber sources. The gradation of both types of CRM when tested in accordance with ASTM C-136 (dry sieve only) and using a 50 gram sample, shall meet the requirements in Table No. 530.3.

Table No. 530.3
CRM Grading Requirements

Sieve Size	Reclaimed Tire CRM Percent Passing	High Natural CRM Percent Passing
#8 (2.36 mm)	100	100
#10 (2 mm)	98 - 100	100
#16 (1.18 mm)	45 - 75	95 - 100
#30 (600 µm)	2 - 20	35 - 85
#50 (300 µm)	0 - 6	10 - 30
#200 (75 µm)	--	0 - 1

The use of CRM from multiple sources is acceptable provided that the overall blend of rubber meets the gradation requirements.

The individual CRM particles, irrespective of diameter, shall not be greater in length than 3/16 of an inch (5mm).

The CRM shall have a specific gravity of between 1.10 and 1.2 as determined by California Test 208, and shall be free of loose fabric, wire, and other contaminants except that up to 4 percent (by weight of rubber) calcium carbonate or talc may be added to prevent the rubber particles from sticking together. The rubber shall be sufficiently dry so as to be free flowing and not produce a foaming problem when blended with the hot asphalt cement. The CRM shall be ac-

cepted by certification from the rubber supplier. The Reclaimed Tire CRM shall conform to the chemical analysis in Table No. 530.4 and the High Natural Rubber CRM shall conform to the chemical analysis in Table No. 530.5.

Table No. 530.4
Reclaimed Tire CRM Chemical Requirements

Test	ASTM Test Method	Minimum	Maximum
Acetone Extract	D 297	6.0 %	16.0 %
Ash Content	D 297	--	8.0 %
Black Content	D 297	28.0 %	38.0 %
Rubber Hydrocarbon	D 297	42.0 %	65.0 %
Natural Rubber Content	D 297	22.0 %	39.0 %

Table No. 530.5
High Natural Rubber CRM Chemical Requirements

Test	ASTM Test Method	Minimum	Maximum
Acetone Extract	D 297	4.0 %	16.0 %
Rubber Hydrocarbon	D 297	50.0 %	--
Natural Rubber Content	D 297	40.0 %	39.0 %

D. Asphalt Rubber Binder

The temperature of the blended paving grade asphalt cement and asphalt modifier (if required) shall not be less than that 375° F (190° C) nor more than 425° F (219° C) when the CRM is homogenously blended in the field. The combined materials shall be reacted for a minimum of 45 minutes after the incorporation of all the CRM. The asphalt-rubber binder shall meet the following criteria in Table No. 530.6 when the reaction is complete.

Table No. 530.6
Specification limits for Asphalt-Rubber Binder

		Hot Climate	Moderate Climate	Cold Climate
Apparent Viscosity, 347° F (175° C) Spindle 3 @ 12 RPM: Cps (ASTM) D2669)	Min. Max.	1500 3500	1500 3500	1500 3500
Penetration, 77° F (25° C), 100g, 5 sec; 1/10 dm (ASTM D5)	Min. Max.	20 75	50 100	75 150
Penetration, 39.2° F (4° C), 200g, 60 sec; 1/10 dm (ASTM D5)	Min.	10	15	25
Softening Point, °F (° C) (ASTM D36)	Min.	135° F (57° C)	130° F (54° C)	125° F (52° C)
Resilience, 77° F (25° C), % (ASTM D3407)	Min.	30	25	15

Climate Definitions

Hot Climate	Average July Max @ 110° F (43° C) Average January Low @ 30° F (-1° C) or above
Moderate Climate	Average July Max @ 100° F (38° C) Average January Low @ 15 - 30° F (-9 to -1° C)
Cold Climate	Average July Max @ 80° F (27° C) Average January Low @ 15° F (-9° C) or lower

The viscosity shall be conducted by using a hand held HAAKE VISCOMETER: Model VT-02 with rotor 1, 24mm in depth x 53mm in height, or equivalent. The reacted asphalt-rubber binder shall be maintained at a temperature of not less than 375° F (190° C) nor more than 425° F (219° C).

If any of the material in a batch of asphalt-rubber binder is not used with-in six hours after the reaction period is complete, heating of the material shall be discontinued. When the asphalt-rubber binder temperature cools below 375° F (190° C) and is reheated, it shall be considered a reheat cycle. The total number of reheat cycles shall not exceed two (2). The binder material shall be uniformly reheated to a temperature of not less than 375° F (190° C). Additional scrap tire CRM may be added to the reheated asphalt-rubber binder and reacted for a minimum of 30 minutes and shall not exceed 10 percent of the total binder weight. Reheated asphalt-rubber binder shall conform to the requirements for blended asphalt-rubber.

E. Asphalt-rubber Binder Formulation

The asphalt-rubber supplier shall furnish to the assigned Engineer within 15 days of the Notice to Proceed, the asphalt-rubber binder formulation which shall contain the following information:

Asphalt Cement

Source of Asphalt Cement
Grade of Asphalt Cement
Percentage of Asphalt Cement by total weight of asphalt-rubber mixture

Asphalt Modifier (if required)

Source of Modifier
Grade of Modifier
Percentage of Modifier by total weight of asphalt-rubber mixture

Reclaimed Tire Rubber (CRM)

Source of CRM
Grade of CRM
Percentage of CRM by total weight of the asphalt-rubber mixture

High Natural Rubber (CRM) (if required)

Source of CRM
Grade of CRM
Percentage of CRM by total weight of the asphalt-rubber mixture

If CRM from more than one source is to be utilized, then the above information will be required for each type of CRM used.

F. Aggregate Cover Material

Aggregate shall be composed of clean and durable crushed rock or crushed gravel conforming to the following requirements:

Proposed aggregate samples shall be submitted to the asphalt-rubber supplier prior to the preparation of the mix design to test the aggregate for stripping characteristics. All testing results shall be submitted to the Engineer.

If the aggregate is to be crushed stone, it shall be manufactured from sound, hard, durable material of accepted quality and crushed to specification size. All strata, streaks, and pockets of clay, dirt, sandstone, soft rock, or other unsuitable material accompanying the sound rock shall be discarded and not allowed to enter the crusher.

If the aggregate material is to be crushed gravel, it shall consist of hard, durable fragments of stone or gravel of acceptable quality and crushed to specification size. All strata, streaks, pockets of sand, excessively fine gravel, clay, or other unsuitable material including all stones, rocks,, and boulders of inferior quality shall be discarded and not allowed to enter the crusher. The crushing of the gravel shall separate the #4, 3/8 and 1/2 inch (4.75, 9, and 12 mm) sieves and shall have a minimum 95% of the particles with a minimum of one fractured face and 90% of the particles shall have a minimum of two fractured faces.

The crushed aggregate shall not contain more than 8% by weight of flat or elongated pieces and shall be free from wood, roots, and vegetable or other organic extraneous matter. The crushed coarse aggregate shall have a percentage of wear not more than 7 at 100 revolutions and not more than 30 at 500 revolutions, as determined by California Test #211.

Film Stripping will be determined according to California Test #302 and shall not exceed 25. Cleanness Value will be determined according to California Test #227 and shall have a minimum value of 80. The Durability will be determined according to California Test #229 and shall have a minimum value of 52.

The aggregate shall show no evidence of disintegration or show a total loss greater than 12% when subjected to 5 cycles of the sodium sulfate accelerated soundness test specified in ASTM C88.

The crushed aggregate for asphalt-rubber applications shall meet the requirements for gradation given in Table No. 530.7, when tested in accordance with ASTM C136.

Table No. 530.7
Aggregate Gradation Requirements

3/8 inch SAM & SAMI Aggregate Gradation		1/2 inch SAM & SAMI Aggregate Gradation	
Sieve Size	Percent Passing	Sieve Size	Percent Passing
1/2 inch (12mm)	100%	3/4 inch (15mm)	100%
3/8 inch (9mm)	70 - 85	1/2 inch (12mm)	95 - 100
1/4 inch (4.75mm)	0 - 15	3/8 inch (9mm)	70 - 85
#8 (2.36mm)	0 - 5	1/4 inch (4.75mm)	0 - 15
#200 (75 µm)	0 - 1	#8 (2.36mm)	0 - 5
---	---	#200 (75 µm)	0 - 1

The aggregate shall be pre-coated or hot pre-coated with 0.5 ± 0.25 percent emulsified asphalt or paving grade asphalt cement. The Engineer shall determine the appropriate amount of pre-coat. The pre-coated aggregate shall have a "salt and pepper" appearance and when used hot shall be supplied to the project site at 250° F to 325° F (121° C to 162° C).

530.3 Equipment:

A. General

The equipment used by the contractor for pavement cleaning and excess aggregate removal shall include a self-propelled rotary power broom, mobile pick-up broom or top dumping mobile pick-up broom.

B. Asphalt-Rubber Equipment

All equipment utilized in the production and application of asphalt-rubber materials shall be described as follows:

1. An asphalt cement heating tank with a hot oil heat transfer system or a retort heating system capable of heating the asphalt cement to the proper temperature for blending with the CRM.
2. An asphalt-rubber mechanical blender shall have a two stage continuous mixing process capable of producing a homogenous blend of asphalt cement and CRM, at the mix design specified ratios, as directed by the Engineer. The unit shall be equipped with a granulated rubber feed system capable of supplying the asphalt cement feed system, as not to interrupt the continuity of the blending process.
3. The maximum capacity of the primary blending vessel shall be 500 gallons (1900 liters). Both the primary and secondary blenders shall be equipped with an agitation device orientated horizontally in the blending vessel. The blending unit shall be capable of fully blending the individual rubber particles with the asphalt cement. A separate asphalt cement feed pump and finished product pump are required. This unit shall have

an asphalt cement totalizing meter in gallons and a flow rate meter in gallons per minute.

4. A trailer mounted self-powered distributor truck equipped with a heating unit, and an internal mixing device capable of maintaining a uniform mixture of asphalt cement and CRM. It shall be equipped with a full circulating spreader bar and pumping system capable of applying asphalt-rubber material within ± 0.05 gallons per square yard tolerance of the specified application rate, and must achieve a uniform covering of the surface to be treated. The distributor shall have a boot board on the rear of the vehicle and a bootman shall accompany the distributor. The bootman shall ride in a position so that all the spray bar tips are in full view and readily assessable for unplugging, if a plugged tip should occur. The distributor shall also include a tachometer, pressure gauge, a volume-measuring device, thermometer and shall also have a computer rate control (CRC) installed.

C. Aggregate Cover Material Spreader

The cover material (chip) spreader shall be a self-propelled machine with an aggregate receiving hopper in the rear, belt conveyers to carry the pre-coated aggregate to the front, and a full width spreading hopper. The spreader shall be in good mechanical condition and be capable of applying the cover aggregate uniformly across the spread width and at the specified application rate. When utilizing hot pre-coated aggregate, heat-treated belts should be installed on the chip spreader.

D. Rolling Equipment

A minimum of three operational self-propelled pneumatic-tired rollers shall be used for the required rolling of the cover material. The pneumatic-tired rollers' shall carry a minimum loading of 3,000 pounds (1361 kg) on each wheel at a minimum pressure of 90 pounds per square inch in each tire.

E. Hauling Equipment

Trucks for hauling the cover aggregate shall be tailgate discharge and shall also be equipped with a device to lock onto the hitch of the cover material spreader. Haul trucks shall also be compatible with the cover aggregate spreader so that the dump bed will not push down on the spreader when fully raised, or have too short of a bed which results in aggregate spillage while dumping into the receiving hopper.

530.4 Construction Methods:

A. General:

Immediately prior to the application of the asphalt-rubber membrane, the surface shall be thoroughly cleaned in order to insure adequate adhesion of the asphalt-rubber to the existing pavement surface.

B. Weather Conditions:

Asphalt-Rubber material shall be applied only when the existing surface is dry and the atmospheric temperature is above 55° F (13° C) and rising. No material shall be applied when rain is imminent or when the wind is excessive.

C. Asphalt-Rubber Mixing and Reaction:

The percentage of Reclaimed Tire Rubber CRM shall be 15-20 percent by weight of the total asphalt-rubber mixture; the exact CRM content shall be determined by the binder design submitted by the asphalt-rubber supplier. During membrane placement the CRM percentage shall not fluctuate by more than 1 (one) percent by weight of total asphalt-rubber mixture. The High Natural CRM shall be 2 - 6 percent, which will replace an equal percentage of the Reclaimed Tire Rubber CRM.

The temperature of the asphalt cement shall be between 375° F and 450° F (190° C and 231° C) at the addition of the CRM. The asphalt cement shall be combined and mixed together in the asphalt-rubber blending unit and reacted in the distributor or a reaction vessel for a minimum period of the asphalt-rubber mixture shall be over 350° F (176° C) during the reaction period, but shall not exceed 450° F (231° C) at any time. Exceeding the 450° F (231° C) limit will be grounds for rejection of the affected binder material.

When a job delay occurs after full reaction, the asphalt-rubber may be allowed to cool. The asphalt-rubber binder shall be re-heated slowly just prior to application to a temperature between 350° F and 400° F (176° C and 204° C). An additional quantity of asphalt cement and / or CRM may be added as required to produce a material with the appropriate viscosity. See reheat cycle in Caltrans Standards.

D. Application of Asphalt-Rubber Binder:

Placement of the asphalt-rubber membrane shall be blended only under the following conditions:

1. The pavement surface temperature shall be 50° F (10° C) and rising.
2. The pavement surface is clean and dry.
3. The wind conditions are not excessive.
4. All of the construction equipment such as the asphalt-rubber distributor, aggregate spreader, haul trucks loaded with cover material, rollers and brooms are in position and ready to commence placement operations.
5. Rain is not imminent.

The asphalt-rubber mixture shall be applied to the roadway immediately following mixing and reaction at a temperature of 350° F and 400° F (176° C to 204° C) at a rate of 0.55 to 0.75 gallons per square yard (2.42 to 3.30 liters per square meter). Transverse joints shall be constructed by placing building paper across and over the end of the previous asphalt-rubber application. Once the application has progressed beyond the paper, the paper shall be removed immediately

and disposed of as directed by the Engineer. The use of paper may be discontinued if the Contractor chooses to squeegee the excess asphalt-rubber binder material at the transverse joints prior to the placement of the cover aggregate. All longitudinal joints shall not exceed a 12 inches (30 cm) overlap.

Distributor bar height, distribution, speed and shielding materials shall be utilized to reduce the effects of excess wind upon the spray distribution (fan). The Engineer shall delay or reschedule work when high gusting or dirty wind prevent or adversely affect binder or aggregate application.

The application of asphalt-rubber binder to areas not accessible with the distributor bar on the distributor truck shall be accomplished by using pressurized hand wands or other means approved by the Engineer.

The Contractor shall comply with all Federal, State, and Local environmental laws, regulations and ordinances including but not limited to air quality requirements.

E. Application of Aggregate Cover Material:

Cover material shall be applied immediately onto the asphalt-rubber membrane, after application, at a rate of 26 to 34 pounds per square yard (11.79 to 15.42 kilograms per square meter). The actual amount selected within this range will be determined in the field based on the appearance of the SAM after initial rolling. At all times the application rate shall be kept to a minimum.

At the time of the application, when using hot pre-coated aggregate, the temperature of the aggregate shall range from 250° F to 325° F (121° C to 162° C).

F. Rolling:

At least three operational pneumatic-tired rollers and one steel wheel roller as directed by the Engineer, shall be utilized. Usage of the steel wheel roller should be based on the hardness value of the aggregate material. Sufficient rollers shall be provided to accomplish the required embedment of the aggregate cover material. At some project locations, or when production rates dictate, additional or fewer rollers may be utilized as directed by the Engineer. At no time shall there be less than 3 (three) operational pneumatic-tired rollers and 1 (one) 12 to 14 ton operational steel wheel roller on a project.

Sufficient rollers shall be used for the initial rolling to cover the width of the aggregate spread with one pass. The first pass shall be made immediately behind the cover material spreader as the aggregate is being placed. If the spreading is stopped for an extended period, the cover material spreader shall be moved ahead or off the side so that all cover material may be immediately rolled. Three complete passes with rollers shall be made with the pneumatic-tired rollers and one pass with the steel wheel roller.

G. Flush Coat:

For SAM applications, a fog seal or flush coat shall be applied during the same day of the placement of the SAM. The surface shall be dry and free of loose material at the time of application. This time-frame may be extended by the Engineer when weather and / or traffic conditions are not favorable. The flush coat shall not be applied when the surface is wet or when there is threat of rain. The ambient temperature shall be at a minimum of 70° F (21° C).

Asphaltic emulsion shall be grade CSS1, CSS1H or CQS1H diluted 50/50 with water shall be used for the flush coat. Immediately before applying the emulsion, the area to be flushed shall be cleaned of all loose aggregate and foreign material. This will be accomplished by power brooms or pick-up brooms and supplemented by hand brooms when necessary.

The diluted asphalt emulsion shall be well mixed before application and shall be applied by a distributor truck, in sound mechanical condition, at a rate of 0.10 to 0.2. gallons per square yard (0.44 to 0.88 liters per square meter), allowing for a residual after the emulsion “breaks” of 0.03 to 0.06 gallons per square yard (0.11 to 0.23 liters per square meter).

H. Sand Cover:

Sand cover material, **if required**, shall conform to the fine aggregate grading requirements in Section 90-3.03, “***Fine Aggregate Grading***”, of the Caltrans Standard Specifications and these Special Provisions. Sand shall be free from any clay or organic material.

Sand shall be spread by means of a self propelled chip spreader equipped with a computerized device that will allow for application of the sand at a uniform rate over the full width of a traffic lane in a single application. Sand shall be spread at a rate of 2 to 4 pounds per square yard (0.91 to 1.81 kilograms per square meter). The exact rate will be determined by the Engineer. If approved by the Engineer other equipment may be used to spread the sand.

I. Traffic Control:

Except when it is necessary that hauling equipment must travel on the newly applied SAM, traffic of all types shall be kept off the membrane until it has had time to set properly. The speed of the hauling equipment shall not exceed 15 miles per hour (24 kilometers per hour) when traveling over a membrane that has not had sufficient time to properly set.

530.5 Method of Measurement:

A. Asphalt-Rubber Bituminous Material:

The asphalt-rubber bituminous Material shall be measured by the square yard as spread at the specified rate and as accepted work by the Engineer.

B Cover Aggregate Material:

The quantity of the cover aggregate material shall be measured by the square yard (square liter) and as accepted by the Engineer.

C. Flush Coat:

The emulsified asphalt material, diluted 50/50, shall be measured by the square yard (square liter) at the specified application rate and as accepted by the Engineer.

D. Sand Coat:

The quantity of the sand cover material shall be measured by the square yard (square liter) and as acceptable by Engineer.

530.6 Basis of Payment:

Payment shall be made at the contract unit price by the square yard of road surface covered at the specified application rate for the asphalt-rubber bituminous material used in the SAM application, the emulsified asphalt flush coat and the aggregate cover material. These prices shall be full compensation for furnishing all materials and for all preparation, hauling, and application of the materials, including labor, equipment and incidentals necessary to complete the item.